The F-22 Multi-Mission Air Superiority Fighter
Cornerstone of Air Force Modernization

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As America moves into the 21st Century, air superiority over potential battlefields will be critical to our nation's security. As General Chuck Horner, the architect of the air war during DESERT STORM, stated, “Everything is possible if you have it...little is possible if you lose it.” Air superiority is the first combat objective of any Joint Force Commander (JFC), and a prerequisite for the introduction of troops in theater.

Growing Threat to US Dominance

The need for a new air superiority fighter is driven by the threat the U.S. will face early in the next century. That threat includes not only advanced fighter aircraft but also increasingly lethal Surface-to-Air Missiles (SAMs).

Advanced fighters are being developed by several countries and will be available for export. These advanced fighters, including the French Rafale, Eurofighter 2000, and Russian Su-35, equal or surpass the performance of current U.S. air superiority fighters. The F-22 will remain in service to the year 2030 and beyond, pitting it against threats with more advanced capabilities than even these known systems.

The sophistication of SAM systems continues to advance with longer range radar, anti-jamming protection, and higher capability missiles. Advanced SAM systems, due to their relatively low cost and demonstrated effectiveness, are a quick way for countries to improve their air defenses. The number of countries possessing the most advanced SAMs--SA-10/12 class--is expected to increase from today’s 14 to 21 in 2005. As a result, these lethal SAMs will overwhelm our current fighter force’s ability to gain air superiority.

Current US fighters can not be upgraded to guarantee Air Superiority and low intensity conflicts are not low technology. Without an extensive supporting electronic warfare force, survivability of existing fighters is doubtful. When developed in the mid-70’s, the F-15 was designed to maintain air superiority at least through the 1980’s. It has performed admirably, but it is unable to dominate the emerging threats. The F-15 will be nearly 30 years old when replaced by the F-22—older than many of the pilots flying the aircraft (see Figure 1). Without major upgrades, the cost of sustaining the current F-15 fleet may increasingly hinder Air Force modernization.

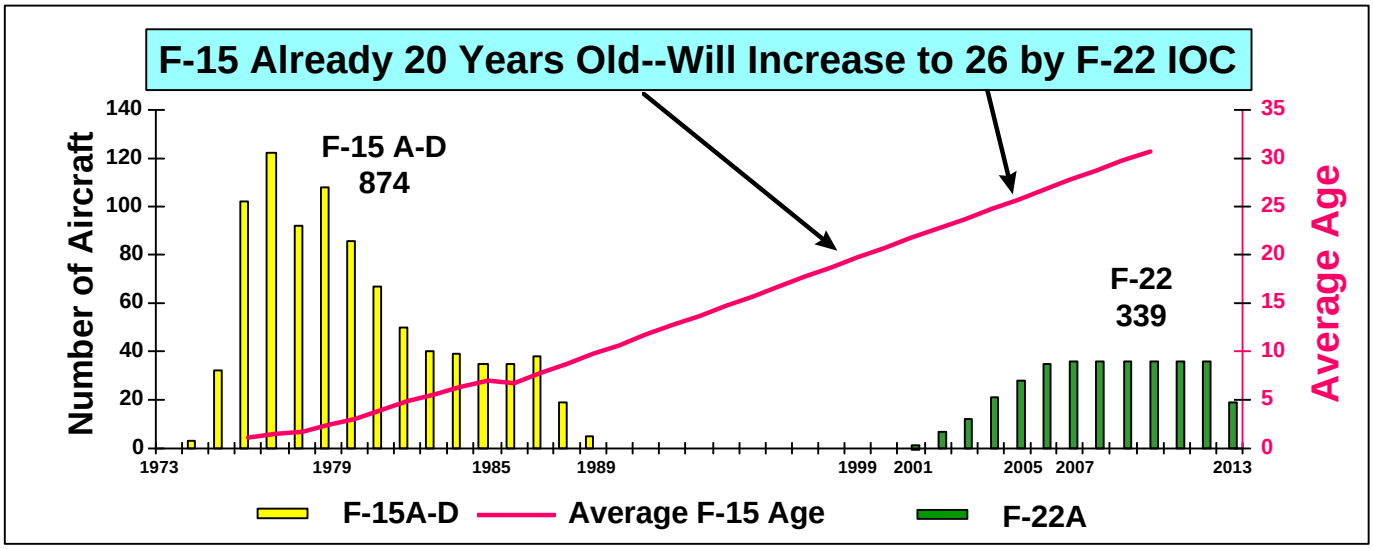

Figure 1: F-15 and F-22 Delivery Comparison

Air Superiority for Today and for 2020+

To meet the growing threat, America needs an air superiority fighter capable of fighting outnumbered over enemy territory. The F-22 is that aircraft. The F-22 will dominate the future air combat arena by integrating advanced avionics, stealth, and supercruise. By combining data fused from sophisticated on-board sensors with available information received from off-board sources, the F-22's computers will provide its pilots a coherent, integrated, 360 degree view of the battlespace. While integrated avionics allow the F-22 to achieve dominant battlespace awareness, stealth denies crucial information to the enemy. Supercruise reduces the enemy's ability to make effective use of the small amount of information they can gather.

In addition to its dominant air-to-air capability, the F-22 has the flexibility to carry two 1000 pound JDAMs in its internal weapons bay. With GPS guided precision weapons, the F-22 will have a potent all-weather capability to attack critical targets on the ground (see figure 2).

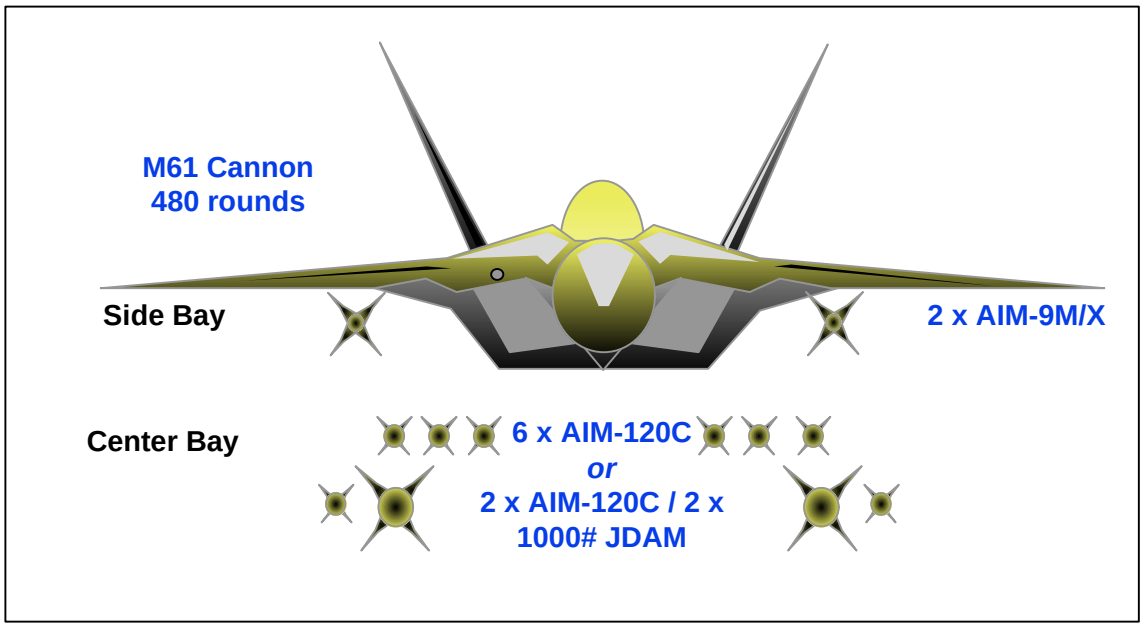

Figure 2 F-22 Alternate Combat Loads

F-22 Development Nearing Completion

With approximately 80 percent of the development effort complete and two test aircraft flying, the F-22 program is nearing the completion of a 13 year development program. The current focus of the program is to demonstrate integration of the various capabilities into a single platform and refine the manufacturing process to be used. In 1998, the test program was both effective and efficient and established the basis for further testing. Accomplishments included 199.9 hours of flight testing (vs. 183 projected) and 2811 test points (vs. 2575 projected). Capabilities successfully demonstrated so far include (see table 1):

F-22 Demonstrated Capabilities

USAF

Matching Predicted Performance

- **Max Altitude: 50,000 feet**
- **Max Mach: 1.40M**

4.76 Hours Supersonic Flight

- **Max G: -1.0 to +6.0G**
- **Max AoA: -10 to +26 degrees**
- **Aerial Refueling & 1724 mile non-stop ferry**

199.9 hours, 94 sorties, 2811 Test Points

Table 1: F-22 Performance Elements Demonstrated in 1998

Avionics Development On Track

The F-22 has an advanced avionics suite incorporating full sensor fusion which increases situational awareness while reducing the pilot's workload. The development of this avionics suite continues on track to meet major program milestones. Key to the avionics development is use of a building block approach, extensive ground laboratory testing, and use of the Flying Test Bed (FTB). The FTB is a modified Boeing 757 aircraft which includes an F-22 radar and forebody, a roof-mounted sensor wing, and an F-22 cockpit simulator. Each software block will be first tested in the FTB prior to actual F-22 testing.

Figure 3 Flying Test Bed

Focus on Affordability

During the development process, the F-22 program experienced cost growth resulting from contractor cost overruns and funding instabilities. The FY98 Defense Authorization Act imposed cost caps in both EMD ($18.9B) and production ($43.1B) in order to provide cost and program stability. The Air Force and contractor team have initiated a series of cost reduction initiatives to ensure both the development and production of the F-22 remain within the cost caps.

F-22 Development Costs Under Control

In July 1998, the Air Force identified approximately $667M of potential cost growth in EMD that could cause the program to exceed the cost cap. This potential cost growth represented "worst case" and was reported by the GAO in its recent report entitled, "F-22 Aircraft—Issues in Achieving Engineering and Manufacturing Development Goals." However, the GAO report didn't highlight that the contractor and government have developed a plan to cover all of the $667M in potential cost growth. This plan involves a combination of application of existing contractor management reserves, deferral of the external combat configuration certification, reduction of test and lab infrastructure, and implementation of development cost-reduction initiatives as shown in table 2. In addition, the government also has management reserves which it has retained to allocate to any unknown-unknown issues.

Development Cost Overview

"Worst Case" Estimate*	
Aircraft Baseline	**$ 14.54B**
Engine Baseline	**$ 2.41B**
Government Costs	**$ 1.52B**
Planned Changes	**$ 1.13B**
Total	**$ 19.60B**
FY98 Cost Cap	**$ 18.94B**
Shortfall	**$(0.66B)**

* Note: This is "potential" cost growth not actual

Proposed Actions**	
Contractor Mgm't Reserve	**$0.18B**
External Stores Deferral	**$0.14B**
Test Infrastructure	**$0.11B**
Lab Infrastructure	**$0.10B**
Gov't Cost Reductions	**$0.05B**
Development Cost Reduction Programs	**$0.08B**
Offsets	**$0.66B**

** The Air Force has additional management reserve not yet allotted to program

Table 2 Development Cost Overview

This plan was approved by the Under Secretary of Defense for Acquisition and Technology in December 1998. Cost control and successful completion of the development program are the primary emphasis within F-22 program management. To increase oversight of cost control and program execution, USD (A&T) has initiated quarterly cost briefings to review cost and technical performance.

Production Cost Focus

With completion of the development program nearing, the program is shifting emphasis to the delivery of 339 aircraft within the production cost cap. To establish a baseline within the cap, the Air Force/contractor team developed and implemented cost reduction initiatives to reduce the predicted costs by more than $16 billion as shown in Figure 4.

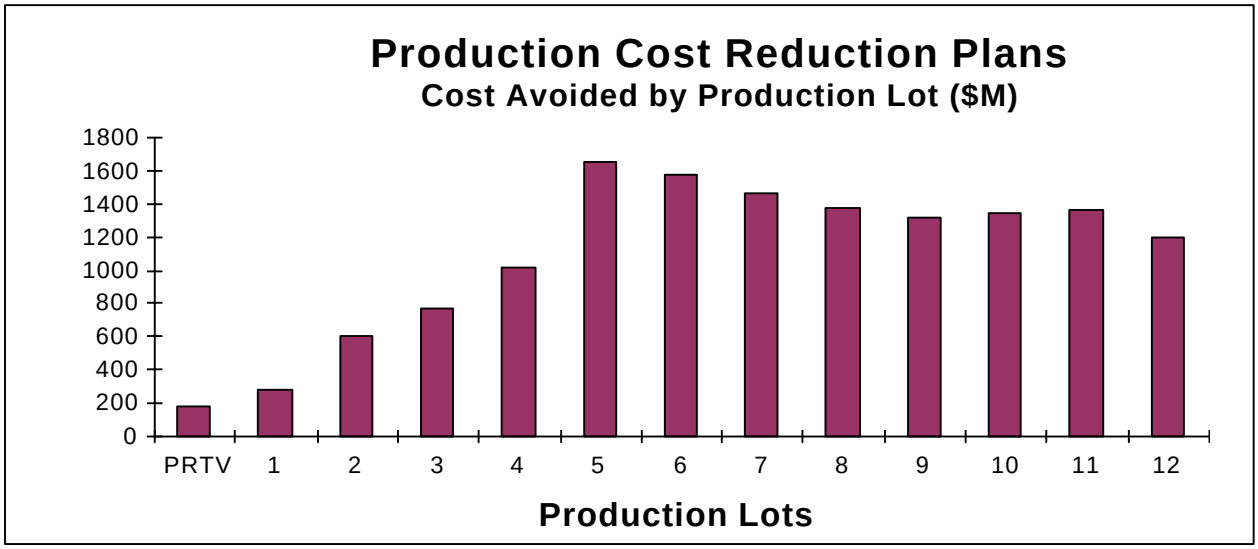

Figure 4 Production Cost Avoidance

Changes in the FY00 Presidents Budget

The FY00 Presidents Budget (PB) initiates purchase of the first six production F-22 aircraft (lot 1) and provides the long lead funding for 10 aircraft in FY01 (lot 2). The FY00 PB submission requests no increase in total program funds but includes an adjustment of $313M in FY00 funding from within the existing FYDP program to align the fiscal year funding with the production requirements and the contractually implemented target price commitment curve for Lots 1-4 and the PRTV aircraft (see Figure 5). The FY00 PB is consistent with an agreement between the Air Force and contractors to complete the production program within the cost cap. With this adjustment, the current F-22 production program funding profile still remains below the production cost cap.

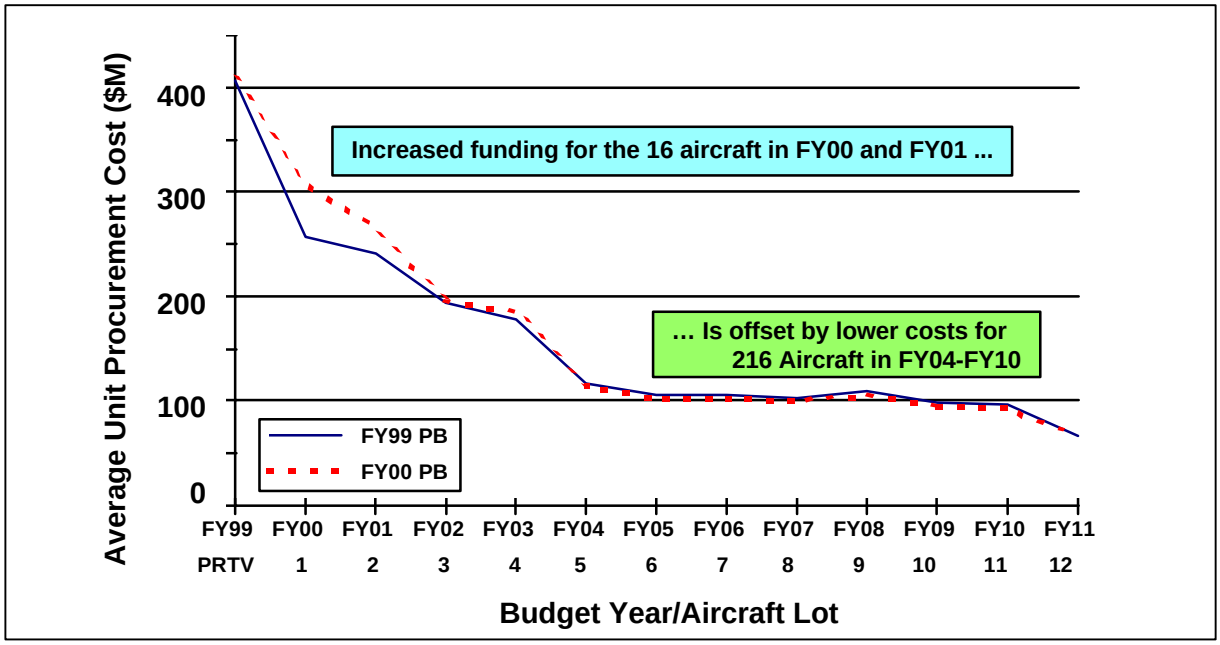

Figure 5 Average Unit Procurement Cost Profile

First Production Contracts Demonstrate Cost Control

The Target Price Curve (TPC) provides an incentive to reduce recurring production costs during Low Rate Initial Production (LRIP), thereby setting the stage for an affordable program (see Figure 6). The TPC charts a clear path toward affordability, and creates a measurement tool against which the contractors' progress can be tracked. By incentivizing investment of corporate dollars to reduce production costs, the USAF has created a performance-based environment in which the contractors have total flexibility to implement cost reduction initiatives in the most efficient/effective manner possible, without the intensive government oversight traditionally associated with cost reduction incentives. The recent negotiation of the first two aircraft buys (two Production Representative Test Vehicles (PRTVs) and six Lot 1 aircraft, plus associated engines) at fixed prices within the TPC demonstrates the TPC concept is showing early indications of success.

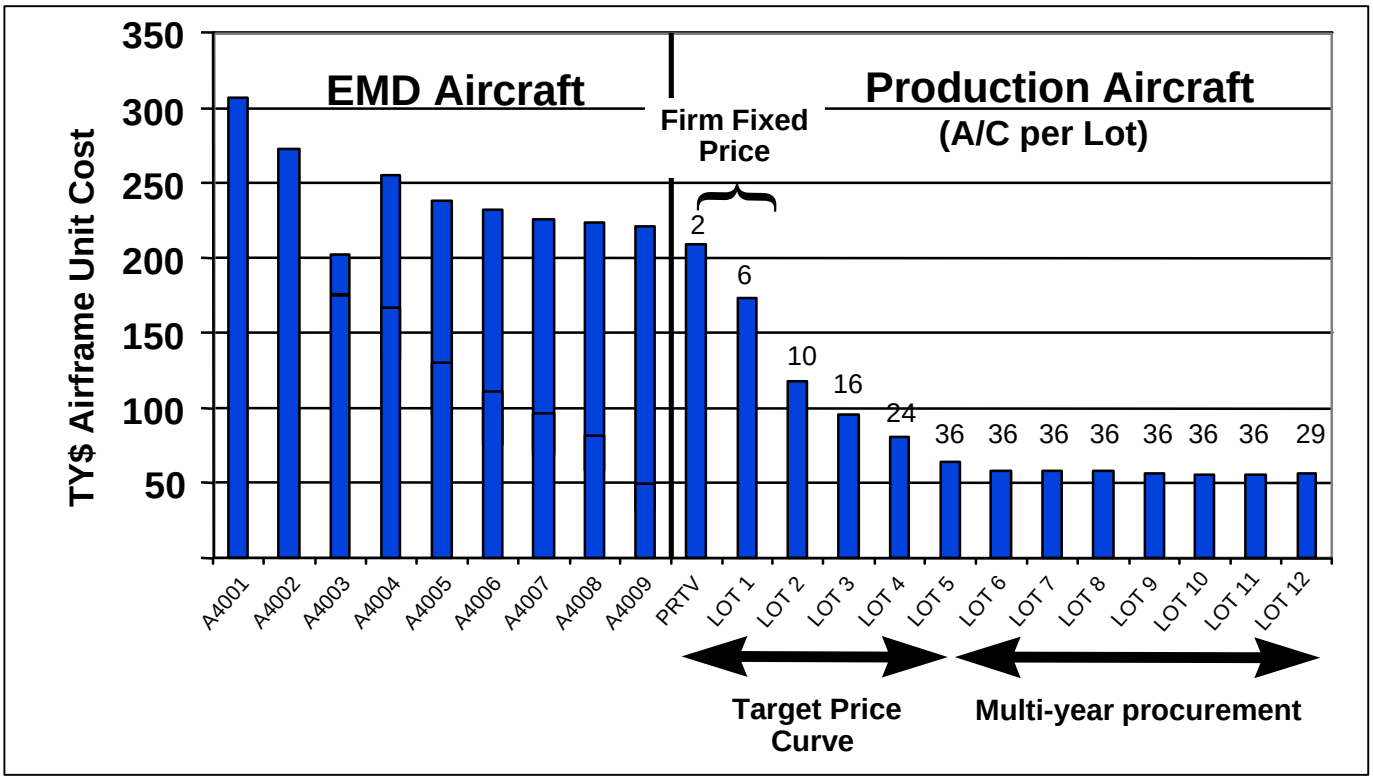

Figure 6 Air Vehicle Unit Target Cost

F-22 Key to Air Force Modernization

The Air Force and contractor team remain committed to the delivery of a revolutionary aircraft for 21st century air dominance within the Congressionally-mandated cost caps. In 1999, the test program will continue to expand the flight envelope of the F-22, the production line will complete major portions of the next three test aircraft, and the avionics development program will demonstrate an unprecedented level of integration; all progressing toward delivery of the first production aircraft in November 2002. Funding stability for this critical modernization effort is essential to ensure the aircraft enters operational service in December 2005.

The F-22 -- Demonstrated Performance in Flight Test & Affordable within Congressional Cost Caps

F-22 - Cornerstone of the 21st Century Air Force